2879

PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of:

Chishio HOSOKAWA et al. Group Art Unit: 2879

Serial No.: 09/750,682 Examiner: Kenneth A. Berck

Filed: January 2, 2001

For: ORGANIC ELECTROLUMINESCENCE ELEMENT AND MANUFACTURING METHOD THEREOF

REQUEST FOR RECONSIDERATION

Mail Stop Non-Fee
Amendment
Commissioner for Patents
P. O. Box 1450
Alexandria, Virginia 22313-1450

Sir:

Applicants request reconsideration of the rejections in the Office Action mailed May 22, 2003 in view of the following comments.

The claims pending in this case are claims 1 to 15 and 17 to 23. Claim 16 was canceled in the Amendment Under 37 CFR 1.111 filed February 21, 2003. Claims 14 and 15 do not seem to have been treated in the most recent Office Action.

PLEASE ACCEPT THIS AS AUTHORIZATION TO DEBIT OR CREDIT FEES TO DEP. ACCT. 16-0331 PARKHURST & WENDEL

The rejection of claims 1 to 4, 8, and 17 to 23 under 35 USC 103 as unpatentable over Bojarczuk, Jr. et al. '185 in view of Jabbour et al. '466 is respectfully traversed.

The newly cited primary references is alleged to show all of the features of the rejected claims but for (1) the location of an organic light emitting medium between a first electrode and a semiconductor layer and (2) using a conductive conjugate polymer in the semiconductor layer (a feature not recited in claim 1). Applicants respectfully submit that the references in combination do not teach or suggest the subject matter claimed here.

The present invention relates to an organic EL element. Fig. 14 (a prior art figure) shows an organic light emitting medium 214 interposed between first and second electrodes 212, 215 and the light emitted from the medium 214 is taken out through either the first or second electrode 212, 215. By necessity, there has to be a restriction on the electrode materials because a material has to be used with high transparency and low electrode resistance. Moreover, the electrode obstructs the transmittance of light at the time the light is taken out. Applicants' invention is directed to overcoming these prior art light transmission difficulties.

The present invention, in contrast to the prior art, constitutes (see Fig. 1) an organic light-emitting medium 12 interposed between a first electrode 10 and a semiconductor layer 14 and a second electrode 10, 16 connected to an edge section of the semiconductor layer 14. When light is taken out through the semiconductor layer 14, both the first and second electrodes 16 do not have to be transparent. Consequently, low resistance opaque materials can be used for each electrode. Moreover, because the electrode does not obstruct transmittance of light at the time light is taken out, the quantity of light taken to the outside increases. Lastly, because the semiconductor layer is made from non-monocrystalline materials, one can obtain a large area organic EL element; see the discussion at page 4, lines 7 to 20 in the specification. The references, neither alone nor in combination, do not suggest the present invention for the following reasons.

The Bojarczuk, Jr. et al. '185 device is not an organic EL element but rather is a hybrid organic-inorganic semiconductor light emitting diode; see column 1, lines 52 to 61 and the title of the patent.

Fig. 1 of the reference shows that in the inorganic semiconductor light-emitting diode, a voltage is applied to the p-layer 14 and the n-doped region 12 after which electrons injected from layer 14 recombine with positive holes injected from the n-doped region 12 at a contact region 17 to emit light; see column 3, lines 30 to 32. (Both region 12 and layer 14 are made of inorganic materials; see Fig. 1.) That is, the light-emitting medium in which electrodes recombine with positive holes is formed of the inorganic semiconductor contact region 17. The semiconductor contact region 17 has to be inorganic because it is located between two inorganic layers (12 and 14). The present invention, in contrast, (see Fig. 1) has the positive holes in the inorganic EL element recombined with electron, supplied from the semiconductor layer 14 at the organic light emitting medium 12 to emit light. Applicants' claims specify unquestionably that the light-emitting medium is "organic."

Although not expressly indicated as such in the Office Action, applicants believe that the Examiner may regard the Alq3 layer 20 in Bojarczuk, Jr. et al. '185 as an organic light-emitting medium. Applicants point out that the function of this layer is to convert

380 nm light emitted from the inorganic semiconductor into 350 nm light; see the patent at column 3, lines 22 to 24 and although the patent at column 3, lines 26 and 27 describes element 20 as "the photoluminescent organic thin film," it is clear, for the reasons given above, that the layer is not an organic light-emitting medium. (See also column 1, lines 40 and 41 of Jabbour et al. '466 where a similar layer is described as an "electron transport layer (ETL).")

The present invention in contrast provides a field for recombining positive holes with electrons to emit light (see page 14, lines 12 to 14) meaning that layer 20 in the reference differs from the organic light emitting medium of the instant claims.

The Examiner has also asserted that layer 12 in the primary reference has a second electrode 18. Applicants respectfully disagree. While the element 18 in Fig. 1 of the reference may appear to be a second electrode, element 18 actually is a second electrical contact which is formed etching away of the n-doped region 12 by reactive ion etching (RIE); see column 3, lines 16 to 18. Element 18 is not an electrode and the reference therefore does not teach or suggest the second electrode claimed herein. The

secondary reference does not supply what is missing from the primary reference.

Jabbour et al. '466 discloses an emitting element having an organic light-emitting medium located between an anode 20 and a cathode 40; see Fig. 1 of the reference.

It is stated in the Office Action that the secondary reference discloses a semiconductor layer made of a conductive conjugate polymer with an auxiliary second electrode but applicants do not understand what layer in Fig. 1 of Jabbour et al. '466 is regarded as a semiconductor layer.

As noted already, the Bojarczuk, Jr., et al. '185 light emitting medium is an inorganic semiconductor meaning that the reference device and the instantly claimed device are quite different in structure. No rationale is given why one of ordinary skill in the art would replace an inorganic layer with an organic light-emitting medium.

Moreover, there is no proper motivation to combine the Jabbour et al. '466 teaching of a light emitting medium and place that medium between the electrical contact 16 and the semiconductor layer (p layer) 14 in the Bojarczuk, Jr. et al. '185 device. (The

only motivation is a distinctly improper one provided by the hindsight achieved by reading applicants' specification and claims.) The rejection should be withdrawn.

The rejection of claims 5 to 7 under 35 USC 103 as unpatentable over Bojarczuk, Jr. et al. '185 in view of Shimoda et al. '527 is also respectfully traversed.

The differences between the instantly claimed invention and the Bojarczuk, Jr. et al. '185 device have been discussed above.

Shimoda et al. '527 discloses a light emitting element 20 used in an information recording apparatus or an information reproducing apparatus. An inorganic light emitting material or an organic light emitting material can be used for element 20; see Fig. 1 and the discussion in the patent at column 6, lines 5 to 23. One can use ZnS:Mn to obtain yellow/orange light as the inorganic light emitting material; see column 6, line 18.

Shimoda et al. '527 also discloses that SiO_2 can be used as a reflective layer 42, 43 of a light emitting element 43; column 11, line 67 to column 12, line 4.

The present invention in contrast to the discussion in Shimoda '527 relates to an organic EL element where its light-emitting

medium is made of organic compounds. ZnS and SiO_2 can be used in the present invention in a semiconductor layer because they are mono-crystal semiconductors and have high light transmittance. Shimoda et al. '527 discloses neither the light transmittance of ZnS or SiO_2 or the use thereof in a semiconductor layer. The references do not teach or suggest the invention as claimed and the rejection should be withdrawn.

Applicants lastly respectfully traverse the rejection of claims 9 to 13 under 35 USC 103 as unpatentable over Bojarczuk, Jr. et al. '185 in view of Domen et al. '403.

The deficiencies of Bojarczuk, Jr., et al. '185 have been discussed extensively above.

Domen et al. '403 is cited to show a semiconductor layer having a particular band gap thickness, resistance, electric charge concentration, and light transmittance.

Domen et al. '403 discloses a semiconductor laser and a semiconductor light-emitting device. The light-emitting medium of the reference is an inorganic semiconductor combined with an n-type semiconductor layer and a p-type semiconductor layer similar to the arrangement in the inorganic semiconductor light emitting diode of

Bojarczuk, Jr. et al. '185. The present invention, as already pointed out above, relates to an organic EL element with a light-emitting medium made from organic compounds. Moreover, the listing of various properties or characteristics of a semiconductor layer, without more, does not teach or suggest the features of the invention as claimed here. The claims patentably define over these references. The rejection should be withdrawn.

Applicants see no rejection of claims 14 and 15. It is respectfully submitted that all pending claims are patentable and a USPTO paper to those ends is earnestly solicited.

The Examiner is asked to express his view regarding the Request For Approval of Drawing Change filed February 21, 2003.

The Examiner is requested to telephone the undersigned if anything further is required in the case prior to allowance.

Respectfully submitted,

PARKHURST & WENDEL, L.L.P.

August 29, 2003
Date

Charles A. Wendel
Registration No. 24,453

CAW/ch

Attorney Docket No.: HEIW:003

PARKHURST & WENDEL, L.L.P.
1421 Prince Street, Suite 210
Alexandria, Virginia 22314-2805
Telephone: (703) 739-0220